The Columbia Integrated Speech Interpretation System (CISIS)

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The information from ancillary departments, such as radiology reports, is vital to many Computerized Decision Support Systems (CDSS).[1] Unfortunately, radiographic reports are typically in free-text form, while CDSS require well-structured, coded data. This has left the system designers with two options. First, the radiologists can be induced to input coded data for the CDSS to use. Although this has been accomplished at a few sites[1], radiologists are generally resistant to giving up their text reports, especially for complex cases.

An second approach is to utilize Medical Language Processing (MLP) to generate coded data from the free-text report. Like several other systems, the production MLP system in use at Columbia processes radiology reports in batch mode after the report has been transcribed.[2] Except during initial system design and testing, the radiologist never sees the coded results. Even if the accuracy of the MLP system is verified on a statistical sample of reports, the characteristics of natural language are such that no MLP system can ever guarantee 100% accuracy for an individual report. Ideally, the results of the MLP should be verified by the radiologist while the images are still present.

Although both Automated Speech Recognition (ASR), and MLP have each been applied to radiology independently, [1,3] the CISIS project goes one step further by combining ASR with real-time MLP and a novel user interface so that encoded data from the report can be displayed while the images are present. Since the ASR, MLP and user interface are each discrete components, each can be modified or evaluated independently. The initial domain for the system is mammography.

The ASR component of CISIS utilizes a commercial, discrete, speaker-dependent, free-text system (IBM VoiceType). An initial evaluation of the ASR component on mammogram reports showed an overall error rate of 1.6% (0.9 errors/report), which was comparable to our human transcribers.

The MLP component utilizes the MedLEE system[2] currently in daily use at Columbia for the processing of chest radiography and mammography reports. The performance of the MedLEE system, when coupled with the existing CDSS at Columbia, has previously been shown to be equal to human experts. To perform the real-time encoding, the MedLEE has been converted to a networked MLP server. (For demonstration purposes, this server will reside on the same PC as the ASR component.)

It is not sufficient to simply link ASR and MLP systems together. The raw output of the MLP system is designed for CDSS and is not in a "human readable" format (HRF). A major thrust of the CISIS project is the development and evaluation of appropriate HRFs. Although full text generation was considered, radiologists already complain about the amount of time required to proof-read the present volume of text reports. It was clear that doubling this work would not be acceptable. The HRF must be significantly more time efficient if the system is to be acceptable to practicing radiologists.

CISIS currently supports three display formats. In addition to the "raw" MedLEE output formats, HL7 and nested list, one HRF, a "finding outline", is available. Other HRFs are being developed and will be included in the demonstration.

Attendees are invited to bring samples of mammography report text from their institutions for interpretation by the system.

References

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